

Applicants : James Robert Durrant et al
Page No. : 2

CLAIMS

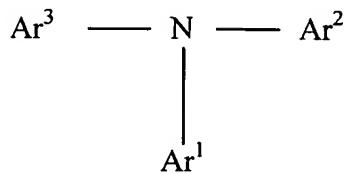
1. (currently amended) A composite structure[, ~~the structure~~] comprising:
a dual-function material intermediate a conducting material and a semiconductor;
wherein the conducting material comprises at least one of an ohmic conductor, a semiconducting
material [~~or~~] and an ionic conductor; and
wherein the dual-function material comprises an organic material and at least one ionic
species[~~; ;~~], said organic material comprising at least one moiety represented by the general
formula (I):



(I)

wherein [Y] comprises an organic semiconductor; and wherein X comprises an ion-chelating
group, said organic material having both electronic charge transport properties and supporting or
chelating the at least one ionic species.

2. (currently amended) [A] The structure [~~according to~~] of claim 1, wherein [Y] comprises a
moiety represented by the general formula (II):



(II)

wherein Ar¹, Ar² and Ar³ are independently substituted or unsubstituted aromatic or hetero-
aromatic rings or fused or [~~otherwise~~] conjugated derivatives thereof.

3. (currently amended) [A] The structure [according to] of claim 1, wherein [Y] comprises at least one of poly(1,4-phenylene), polypyrrole, poly(p-phenylenevinylene) (PPV), poly(thiophene), MEH-PPV, polyaniline [or] and PEDOT.
4. (currently amended) [A] The structure [according to any of claims 1 to 3] of claim 1, wherein X comprises at least one [group selected from] of: [-($\text{CH}_2\text{CH}_2\text{O}$)_n $\text{CH}_2\text{CH}_2\text{OCH}_3$], [-(OCH_2CH_2)_n OCH_3], [-($\text{CH}_2\text{CH}(\text{R})\text{O}$)_n $\text{CH}_2\text{CH}_2\text{OCH}_3$] and [-($\text{OCH}(\text{R})\text{CH}_2$)_n OCH_3]; wherein n is an integer[, preferably] of 2 to 10[, more preferably 2 to 4]; wherein R is straight or branched alkyl chain of 1 to 10 carbon atoms[, preferably of 1 or 2 carbon atoms].
5. (currently amended) [A] The structure [according to any of claims 1 to 3] of claim 4, wherein X comprises at least one of a crown ether, a podand, a lariat ether, a cryptand [or] and a spherand.
6. (currently amended) [A] The structure [according to any preceding] of claim 1, wherein the at least one ionic species is [chosen from] selected from the group consisting of: Li^+ , Na^+ , K^+ , Cs^+ , Mg^{2+} , Ca^{2+} , triflimide, halide, perchlorate, trilate and BARF salts of [the above cations] Li^+ , Na^+ , K^+ , Cs^+ , Mg^{2+} , Ca^{2+} .
7. (currently amended) [A] The structure [according to any preceding] of claim 1, wherein the conducting material comprises an ohmic conductor and is [chosen from] at least one of: a metal, graphite, a highly-doped semiconductor and an organic conductor.
8. (currently amended) [A] The structure [according to any of claims 1 to 6] of claim 1, wherein the conducting material comprises a semiconducting material [and is chosen from] being at least

one of: TiO₂, ZnO, SnO, Ta₂O₅, Nb₂O₅, WO₃, OMeTAD, PPV, Cu-phthalocyanin, polythiophenes, polypyrroles, pentacene and perylenes.[-]

9. (currently amended) [A] The structure [~~according to any of claims 1 to 6~~] of claim 1, wherein the conducting material comprises an ionic conductor and is [~~chosen from~~] at least one of: a polymer electrolyte, and a polymer supporting a redox active species.

10. (currently amended) [A] The structure [~~according to any preceding~~] of claim 1, wherein the semiconductor is [~~chosen from~~] at least one of: TiO₂, ZnO, SnO, Ta₂O₅, Nb₂O₅, WO₃, OMeTAD, PPV, Cu-phthalocyanin, [~~elio or~~] oligo or oligothiophenes, polythiophenes, polypyrroles, TPDs, pentacene and perylenes.

11. (currently amended) [A] The structure [~~according to any preceding~~] of claim 1, wherein the semiconductor is porous and the dual-function material is at least partially contained within the pores of the semiconductor.

12. (currently amended) An electrochemical device[,-the device] comprising:
a structure [~~according to any preceding claim and one further, or~~] including a dual-function material intermediate a conducting material and a semiconductor;
wherein the conducting material comprises at least one of an ohmic conductor, a semiconducting material and an ionic conductor; and
wherein the dual-function material comprises an organic material and at least one ionic species,
said organic material comprising at least one moiety represented by the general formula (I):

[Y]-X

(I)

wherein [Y] comprises an organic semiconductor; and wherein X comprises an ion-chelating group, said organic material having both electronic charge transport properties and supporting or chelating the at least one ionic species; and
at least two external ohmic conductors [such that the device is provided with two external ohmic conductors] in electrical communication with the structure.

13. (currently amended) A photo-voltaic cell[,~~the cell~~] comprising:
a structure [~~according to any of claims 1 to 11~~] including a dual-function material intermediate a conducting material and a semiconductor;
wherein the conducting material comprises at least one of an ohmic conductor, a semiconducting material and an ionic conductor; and
wherein the dual-function material comprises an organic material and at least one ionic species, said organic material comprising at least one moiety represented by the general formula (I):

[Y]-X

(I)

wherein [Y] comprises an organic semiconductor; and wherein X comprises an ion-chelating group, said organic material having both electronic charge transport properties and supporting or chelating the at least one ionic species.

14. (currently amended) [A] The device [according to] of claim 12 [which is] wherein the structure and at least two ohmic conductors are included in at least one of a photodiode, a battery, an electrode, an electrochromic device [or] and a light-emitting diode.